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Estimating spatial patterns of biomass change across Finland

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Forest characteristics vary largely at regional level and also on smaller geographic areas in Finland. The amount of greenhouse gas emissions is related to changes in biomass and for example to the soil type (e.g. upland soils vs. peatlands). Forest characteristics affects on forest management practices and on how vulnerable single stands are for disturbances. Hence, spatially accurate maps are needed for forest management planning. By means of map data we are able to consider where and which kind of operations in the forests are the most beneficial, e.g., in terms of climate change mitigation. In our study estimating and explaining spatial patterns across Finland is the main interest. For this we have analysed biomass changes on different soil and site types on forest land.

The Finnish Multi-Source National Forest Inventory (MS-NFI) provide multi-temporal thematic raster layers for the whole country on large number of forest variables at pixel resolution of 16 m, e.g., timber volume and biomasses by tree species, land use class, site type (http://kartta.luke.fi/index-en.html). MS-NFI data is based satellite images (Landsat 5 TM/7 ETM+/8 OLI, Sentinel 2A-MSI, IRS P6, ALOS AVNIR-2), digital maps and NFI field data. We used MS-NFI layers from two time points to investigate the spatial variation of biomass. Silvicultural management and treatment units larger than individual pixels were created by automatic segmentation of the thematic forest maps.
The segmentation of thematic maps was carried out using a modified implementation of the ‘segmentation with directed trees’ algorithm, which employs the local edge gradient for recognizing potential segment borders. This operation was done to decrease large random errors related to single pixel observations.

We have produced segmented biomass maps and biomass change maps for the whole country. The biomass maps were evaluated with available data on forest resources, growth and drains, e.g., applying statistics on forestry or forest inventory data. The findings will be discussed in the paper including the spatial evaluation of carbon stock changes. According to previous studies the accuracy of biomass variables is relatively high and close to those on timber volumes. Distribution on forest site types according to thematic maps and field data is also analysed in the study due to it has effects to the emissions from soil. The reasons for the observed biomass changes will be studied and discussed. Decline in biomass are usually caused by timber harvesting, but also due to wind storms or deforestation. The maps on biomass provide useful tool for forest owners to analyse carbon stock changes in their forests and how to affect the amount of carbon by forest management.